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AGRONOMIC ASPECTS OF THE EXPERIMENTAL DAIRY FARM - 1970

by
Edgar M. Daley
Radiological Research Program
Western Environmental Research Laboratory

ENVIRONMENTAL PROTECTION AGENCY

Published March 1972

This research was performed as a part of the Radiation Effects Program and was supported by the U. S. ATOMIC ENERGY COMMISSION under a Memorandum of Understanding No. SF 54 373.

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ABSTRACT

This is an annual report on the agronomy practices of the experimental dairy farm at the Nevada Test Site. The report includes a narrative report and accompanying tables on irrigation, fertilization, and crop production during 1970.

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INTRODUCTION

The Western Environmental Research Laboratory of the Environmental Protection Agency maintains an experimental research farm on the Nevada Test Site. The farm is located approximately 110 miles north of Las Vegas in Area 15 of the Nevada Test Site (see Figure 1), and is situated in a high desert valley (4,500 feet elevation). The soil is a coarse, gravelly, sandy loam with cobbles intermixed, and has a pH of approximately 8.3. Physical description and history of the farmstead are covered in the previous reports[1,2].

This is a continuing report of the agronomy practices of the experimental farm for the year 1970. It is compiled from monthly reports that are written from daily records kept by the Crop Research Helpers. These records document the practices on the farm and supply information that can be used in support of controlled release experiments or in "Ad Hoc" studies that are mounted following any accidental releases from an underground test or releases from reactor testing conducted at the Nuclear Reactor Development Station.

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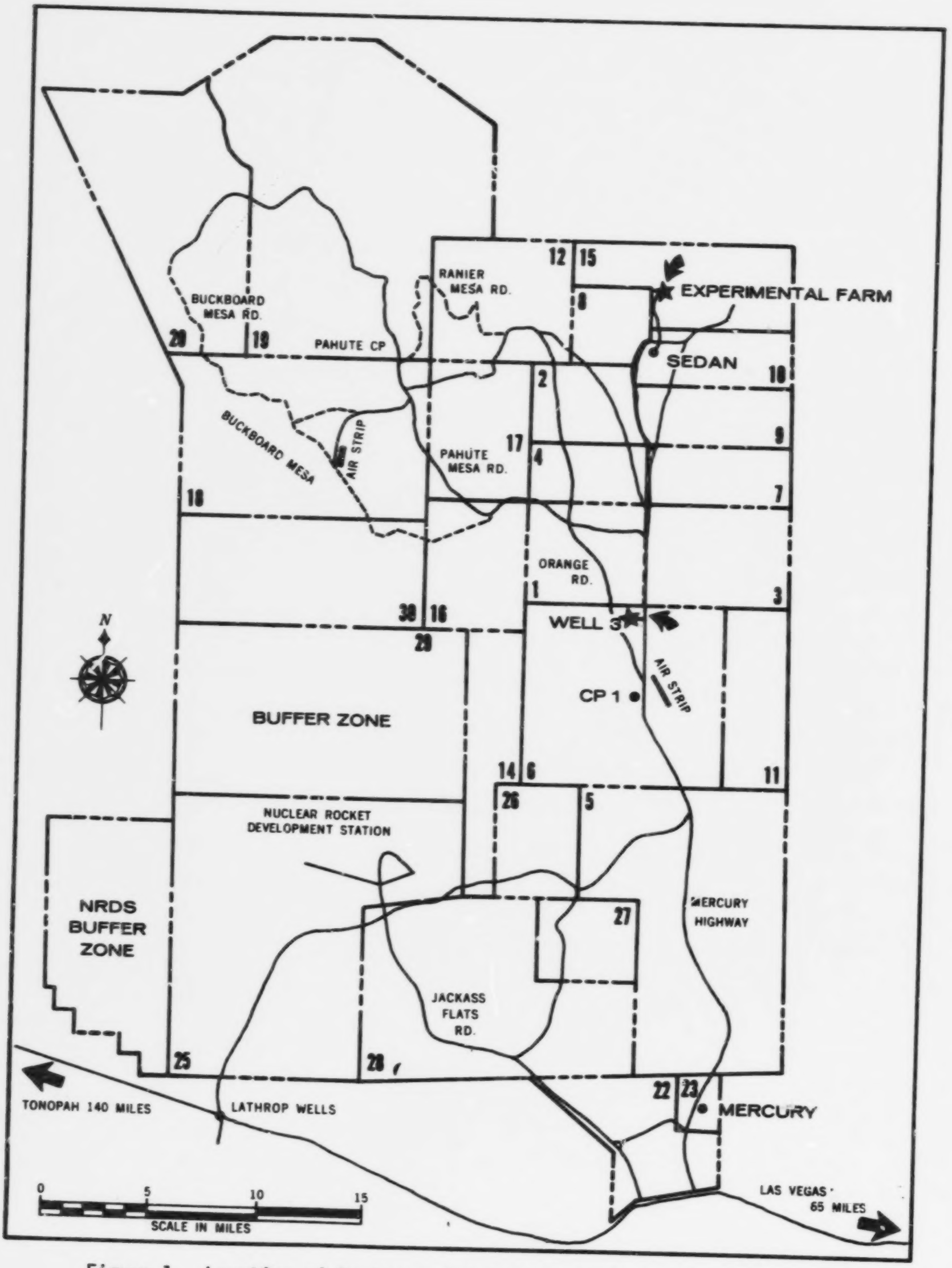

Figure 1. Location of Environmental Protection Agency facilities on the Nevada Test Site.

IRRIGATION

The irrigation season runs from April through October. The total amount of water applied was 84.8 acre feet (325,850 gallons or 1,205,645 liters equals one acre foot) with an average of 5.3 acre feet per land. A land is the area between two irrigation laterals and is approximately one acre. The amounts of water applied to each land each month are shown in Appendix I.

During 1969, 84.4 acre feet of water with an average of 5.2 acre feet of water per land was used. The irrigation period for 1969 and 1970 was applied in the same amounts[3]. Figure 2 shows a comparison between 1969 and 1970 by months.

During the past three years the amount of irrigation water applied per acre has been approximately the same each year. In 1968 5.8 acre feet were applied, in 1969 5.2 acre feet were applied, and in 1970 5.3 acre feet per acre were applied for an average of 5.4 acre feet per acre.

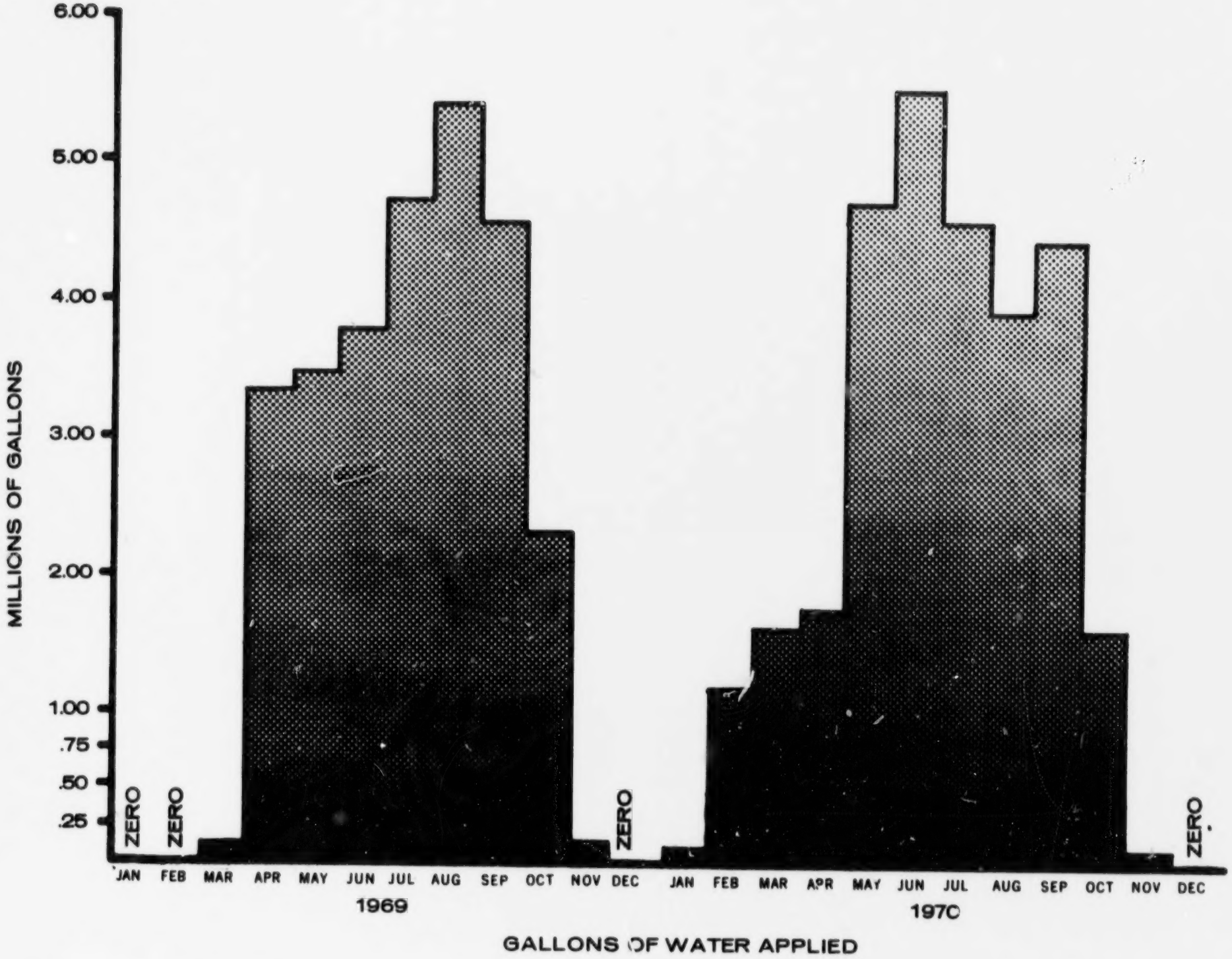
MILLIONS OF GALLONS
6.00
5.00
4.00
3.00
2.00
1.00
.75
.50
.25
ZERO
ZERO
ZERO
ZERO
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1969
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1970
GALLONS OF WATER APPLIED

Figure 2.

FERTILIZATION

The two fertilizers used during 1970 were ammonium sulfate 21-0-0 and trebel superphosphate 0-45-0. Phosphorus was applied to the alfalfa in March at the rate of 144 pounds P_2O_5 per acre (63.4 pounds of P/acre). The two grass and legume lands, 10 and 14, had 36 pounds P_2O_5 per acre (15.8 pounds of P/acre) during the year.

Lands 10 and 14 had applications of 96 pounds N and 80 pounds N, respectively. These amounts were made in two applications. Lands 15 and 16 had applications of 42 pounds N and 36 pounds P_2O_5 (15.8 pounds P) and Land 17 received 16 pounds N during April.

Preplant applications of nitrogen and phosphorus were made on the small grain in October. Lands 15 and 16 each had an application of 73 pounds N per acre and 36 pounds P_2O_5 per acre (15.8 pounds of P/acre), Land 17 had 21 pounds N per acre and 18 pounds P_2O_5 per acre (7.9 pounds of P/acre). The nutrients and the amounts applied to each land are shown in Appendix II.

AGRONOMY PRACTICES

A. Land Preparation and Seeding

Lands 15, 16, and 17 were chisled to a depth of 12-14 inches, disced and spike-tooth harrowed and leveled with a drag float to prepare seed beds for rye grain. Preplant fertilizer was applied in October. The amounts and types have been covered under fertilization.

On October 9, Secale cereale, Elbon variety rye was planted. Excellent germination occurred and a thick stand was established. The rate of seeding was 100 pounds to the acre.

B. Harvesting

The rye grain was green chopped on March 27. This is the earliest that green chopping has occurred at the experimental farm in five years of harvesting green feed.

The small grain that was utilized for green chop was Elbon rye. This is a winter hardy variety that has been used for the last four years. Harvesting of alfalfa green chop began on April 17 and continued through November 3.

The harvesting season lasted a total of 221 days with production of 171.1 tons (10.7 tons per acre or 1548.4 pounds per day wet weight) on 16 acres. Appendix III shows the green chop produced during the

months on each land.

Hay production was lower this year than the preceeding year in spite of the long growing season, it was not a year conducive to alfalfa production. The average was 2.36 cuttings per acre. In previous years there were four to five cuttings. The hay produced was of excellent quality, grade U. S. No. 1 leafy alfalfa hay. Appendix IV shows the hay production per month from the hay production lands.

The amount of hay produced was 47.2 tons on 11 acres with an average of 4.3 tons per acre. Of the 14 acres of alfalfa, 3 were utilized only for green chop and the other 11 acres were utilized for both hay and green chop.

The hay is produced from stands that are four to five years old. The stands are thick and show no signs of thinning out. The alfalfa that is grown is Medicago sativa, Lahonton variety.

C. Weed Control

Both chemical and mechanical means were employed in the control of weeds. The mechanical control in the noncrop areas consisted of uprooting the growing weeds with a rear-mounted blade on a tractor. This was done when the weeds were two to six inches high. This method has to be repeated a number of times during the season.

Two herbicides were used on the vegetable plots in the microplots. These were preplant EPTC (Eptam) ethyl di-n-propyl thiol carbomate, a selective

herbicide and DCPA (Dacthal), a phthalic compound dimethylester of tetra chlorotere-phthalic acid. The herbicides gave good weed control during the season. Some hand hoeing was required in the microplots as barn yard manure had been applied to these plots in previous years which resulted in a weed infestation. During this season no manure was added and the plots are being cleaned of weeds. Along the irrigation laterals and fence rows chemical weed control was used. The chemicals used during 1970 were Rad-E-Cate (Cacodylic acid), Paraquat (Dimethyl-bipyridyliumion), 2-4 Dichlorophenoxyacetic acid and diesel fuel oil. Only weed free seed is sown on the farm which keeps down the introduction of noxious weeds. None of the hard-to-control weeds such as Russian knapweed, Canadian thistle or bindweed are present.

The three small grain lands, 15, 16, and 17, that were in summer fallow were disced three times during the summer to control the weeds.

During the 1970 season no infestations of harmful insects occurred and no chemical insect control methods were required in the crop production area of the experimental farm.

IODINE EXPERIMENTS

Project Washout was conducted on September 29, 1970. Land 5 was utilized for the experiment. The primary purpose of this project was to study, under controlled conditions, the efficiency of the washout process for removal of iodine in various forms by various intensities of rain. Dry ^{131}I labeled diatomaceous earth and elemental iodine were generated to pass over experimental plots of growing alfalfa. A precipitation was generated over certain of these plots during the aerosol passage.

Contamination levels, precipitation levels, size distribution of the aerosol particulates, as well as the precipitation droplets, and the deposition parameters were determined.

Two groups of three cows each were used. One group was fed green chop harvested from the washout plot and one fed dry contaminated green chop to determine the milk secretion parameters. A third group, the control, was fed noncontaminated green chop. Included in this experiment was a determination of the relative T_{eff} in plants between the dry and washout situations. The data from this study will be used with those of previous projects of this series as input to an exposure-dose model for the radioiodines.

Project Washout was the only experiment conducted during 1970 that utilized forage produced on the farm for other than routine feeding operations.

MICROPLOTS

The existing irrigation system was taken out. The portable aluminum irrigation system was replaced with permanent main lines and laterals. Rain Bird "35A" adjustable heads, capable of delivering 7.5 gallons per minute at 50 PSI were installed on the laterals. By installing a bypass and hooking on to the microplots main line, it was possible to utilize the main field irrigation pump to deliver the water to the microplots. The new system gives more efficient utilization of water, time, and labor.

The microplots were chisled to a depth of 12-14 inches to break up a hard pan that had developed, the field was cross disced four times then disced and spike-tooth harrowed to form a good seed bed for the small grains and vegetables that were planted.

Pre-emergence herbicides were used on the vegetables. Eptam was used on the beets, peas, and black-eyed peas. Dacthal was used on Swiss chard, head lettuce, onions, and watermelons. The Eptam seemed to have an effect on the red beets in that the beets germinated, emerged and died. The dying back appeared to be similar to "damping off" so it was not positive that the losses of the beets were due to the herbicides. Damping off is a disease of seeds or young seedlings caused by fungi.

Wheat was planted on May 14. Ramona 50 was the variety planted. The wheat was harvested in August with a yield of 42 bushels (2,520 pounds) per acre.

A higher yield probably would have been realized had the wheat been planted earlier. The alfalfa in the microplots was utilized for green chop.

Samples of the grain and vegetables grown on the microplots were taken and analyzed for tritium concentration. The analytical results are shown in Appendix V.

COMPARISON OF SURROUNDING AREAS

The amount of green chop produced in the Moapa Valley during 1970 from an October 1 planting is: oats, 4.5 tons; barley, 5 tons; and wheat, 5.3 tons. Yield of green chop is expressed in tons per acre dry matter, as the dry weight is approximately 30% of the wet weight. A conversion of the 10.7 tons per acre wet weight gives the average dry weight of the green chop produced on the experimental farm as 3.6 tons per acre, this includes both alfalfa and small grain green chop.[4]

Alfalfa hay production in Southern Nevada averaged 8 tons per acre produced in six cuttings. Lahontan variety yielded 7 tons at Reno in 4 cuttings. This variety is the one that is grown at the experimental farm. Lahontan alfalfa at Knoll Creek, Elko County, Nevada (elevation 5,600 feet) during a three-year period averaged 3.1 tons per acre on three cuttings. The alfalfa production at the farm was 4.3 tons per acre on 2.4 cuttings per acre.[5,6]

Farming operations at the experimental farm follow as closely as possible the recommended practices of commercial farm operations in Nevada and surrounding areas.

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APPENDIX I. Tabulation of Monthly Irrigation

Irrigation: The amounts of water and the totals per month per land are expressed in acre inches of water (27,154 gallons per acre per land). Totals for the year for each land are shown in both acre inches of water and acre feet (325,850 gallons per acre feet).

Lands	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Jan														0.76	0.76	0.76
Feb	1.29	1.29	1.29	1.29	1.29	4.61	6.26	4.61	4.61	4.61	1.65	1.65	1.65	1.91	0.25	0.25
Mar	3.18	3.18	3.18	3.18	3.18	2.81	6.26	4.61	4.61	4.61	1.65	1.65	5.83	4.36	4.36	0.73
Apr	9.59	5.07	5.07	6.65	6.65	1.58	1.58	1.58	1.02	3.19	3.19	3.19	3.19	2.32	2.32	2.32
May	18.43	14.69	9.27	9.12	9.12	11.92	10.96	10.96	7.69	14.35	12.37	10.25	7.50	7.50	2.38	2.38
Jun	18.36	11.49	11.89	9.33	12.34	16.79	15.33	15.12	11.79	9.55	11.84	14.73	14.35	11.47		
Jul	10.41	11.82	11.82	12.00	13.00	13.00	12.84	12.42	12.42	13.19	6.96	5.67	5.67	6.84		
Aug	15.26	13.02	10.09	7.77	7.77	6.85	6.85	10.33	8.26	9.44	7.19	10.14	7.19	8.96	1.76	1.76
Sep	14.23	9.17	8.64	8.64	16.52	13.65	13.93	10.66	15.28	14.83	13.01	6.34	8.71	11.82	7.23	7.23
Oct		4.14	4.14	2.00	2.00	2.00	3.91	3.91	1.77	1.77	1.77	5.79	4.95	4.95	4.95	4.95
Nov													1.27	1.27	1.27	1.27
Dec																
Acre/ Inch	90.75	73.87	65.39	60.98	71.87	73.05	73.06	72.40	67.13	75.22	63.07	62.85	60.31	62.16	25.28	21.65
Acre/ Feet	7.56	6.15	5.44	5.08	5.98	6.08	6.08	6.03	5.59	6.26	5.25	5.23	5.02	5.18	2.10	1.80

84.83 acre feet - average 5.30 acre/feet

1019.04 acre inches - average 63.69 acre/inches

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APPENDIX II. Tabulation of Fertilizer Applied to Each Land

Fertilizer: Nitrogen applied is expressed in pounds of N. Phosphorus applied is expressed in both pounds P_2O_5 and pounds of phosphorus, the latter being in parentheses.

Month	Lands								
	1	2	3	4	5	6	7	8	9
March	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)	144#P_2O_5 63.36#P)	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)

Month	Lands							
	10	11	12	13	14	15	16	17
March	48#N (15.84#P) 36#P_2O_5	144#P_2O_5	144#P_2O_5 (63.36#P)	144#P_2O_5 (63.36#P)	36#P_2O_5 (15.84#P)			
April					32#N	43#N 36#P_2O_5 (15.84#P)	42#N 36#P_2O_5 (15.84#P)	16#N
June	48#N				48#N			
October						73#N 36#P_2O_5 (15.84#P)	73#N 36#P_2O_5 (15.84#P)	21#N 18#P_2O_5 (7.92#P)

APPENDIX III. Green Chop Production for 1970 by Lands

Green Chop: Tons per land (acre)

Month	Land																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Jan																	
Feb																	
Mar																	
Apr						1.60	4.60			2.60				1.80	7.00	5.60	2.40
May				8.60	7.20	3.70				2.10					2.50	1.60	1.80
Jun	3.50				7.20	7.00											
Jul	2.70			4.50	6.30					4.50							
Aug	3.60			3.15	6.30				5.40	3.60				3.15			
Sep	1.80			4.50	0.90	2.70	3.60	3.60	2.70	2.70		2.70		4.50			
Oct	1.50	3.60	4.50		3.30		0.90	0.90	0.90	0.90	3.60		0.90	0.90			
Nov																	
Dec																	
Total	13.10	3.60	4.50	22.25	31.20	15.00	9.10	4.50	9.00	16.40	3.60	2.70	0.90	10.35	13.50	7.20	4.20

Total 171.10 tons - average 10.69 tons per acre

Green chop started on March 27, 1970 through November 3, 1970. A growing period of 221 days. Total 342,200 pounds. 1,548.41 pounds per day.

APPENDIX IV. Hay Production for 1970 by Lands

Hay Production: Tons per land (acre)

Month	Land													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jan														
Feb														
Mar														
Apr														
May								1.98	2.04		2.22	2.16	2.31	
Jun										1.95				2.04
Jul	2.65	2.82		1.65		1.56	1.59	1.50			3.12	3.15	1.53	1.44
Aug	1.50	1.40		1.38		1.14	1.32	0.78			1.38	1.38	1.23	
Sep														
Oct														
Nov														
Dec														
Total	4.15	4.22		3.03		2.70	4.89	4.32		1.95	6.72	6.69	5.07	3.48

Total = 47.22 tons
Average = 4.29 tons per acre
Average cuttings 2.36 per acre

APPENDIX V. Average Tritium Activity in the Free Water of Crops Grown on the Area 15 Experimental Farm Microplots - May - August 1970

Crop	Collection Date		pCi/ml
Beans	5 August 1970	Whole	1.0 average of 3
		Pods	3.2 average of 3
		Tops	2.9 average of 3
		Roots	1.9 average of 3
		Average all parts	2.3
Beets (red)	18 August 1970	Whole	1.6 average of 3
		Leaves	1.4 average of 3
		Roots	1.4 average of 3
		Average all parts	1.4
Black-eyed peas	18 August 1970	Whole	1.9 average of 3
		Pods	2.4 average of 3
		Tops	1.9 average of 3
		Roots	2.8 average of 3
		Average all parts	2.3
Corn (sweet)	5 August 1970	Whole	3.4 average of 3
		Ears	2.7 average of 3
		Stalk and leaves	1.2 average of 3
		Roots	1.1 average of 3
		Average all parts	2.1
Lettuce	5 August 1970	Whole	1.3 average of 3
		Leaves	1.3 average of 3
		Roots	1.3 average of 3
		Average all parts	1.3
Swiss chard	21 July 1970	Whole	1.7 average of 3
		Tops	1.9 average of 3
		Roots	1.5 average of 3
		Average all parts	1.7
Onions	18 August 1970	Whole	1.0 average of 3
		Leaves	1.2 average of 3
		Bulbs	1.0 average of 3
		Average all parts	1.1

APPENDIX V. Average Tritium Activity in the Free Water of Crops Grown on the Area 15 Experimental Farm Microplots - May - August 1970 cont'd

Crop	Collection Date		pCi/ml	
Peas (green)	15 July 1970	Whole	3.0	average of 3
		Pods	5.9	average of 3
		Tops	4.5	average of 3
		Roots	4.9	average of 3
		Average all parts	4.6	
Wheat		Grain only	2.8	

APPENDIX V. Average Tritium Activity in the Free Water of All Parts for the Various Crops Grown During 1969 and 1970 on the Microplots

Crops	pCi/ml	Crops	pCi/ml
1970		1969	
Beans	2.3	Beans	7.1
Beets	1.4	Beets	1.8
Black-eyed peas	2.3	Not grown in 1969	
Corn (sweet)	2.1		
Lettuce	1.3		
Swiss chard	1.7		
Onions	1.1		
Peas (green)	4.6		
Wheat	2.8		